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1960 FIRE WEATHER SEVERITY IN CALIFORNIA

By Arthur R. Pirsko, Research Forester
Division of Forest Fire Research

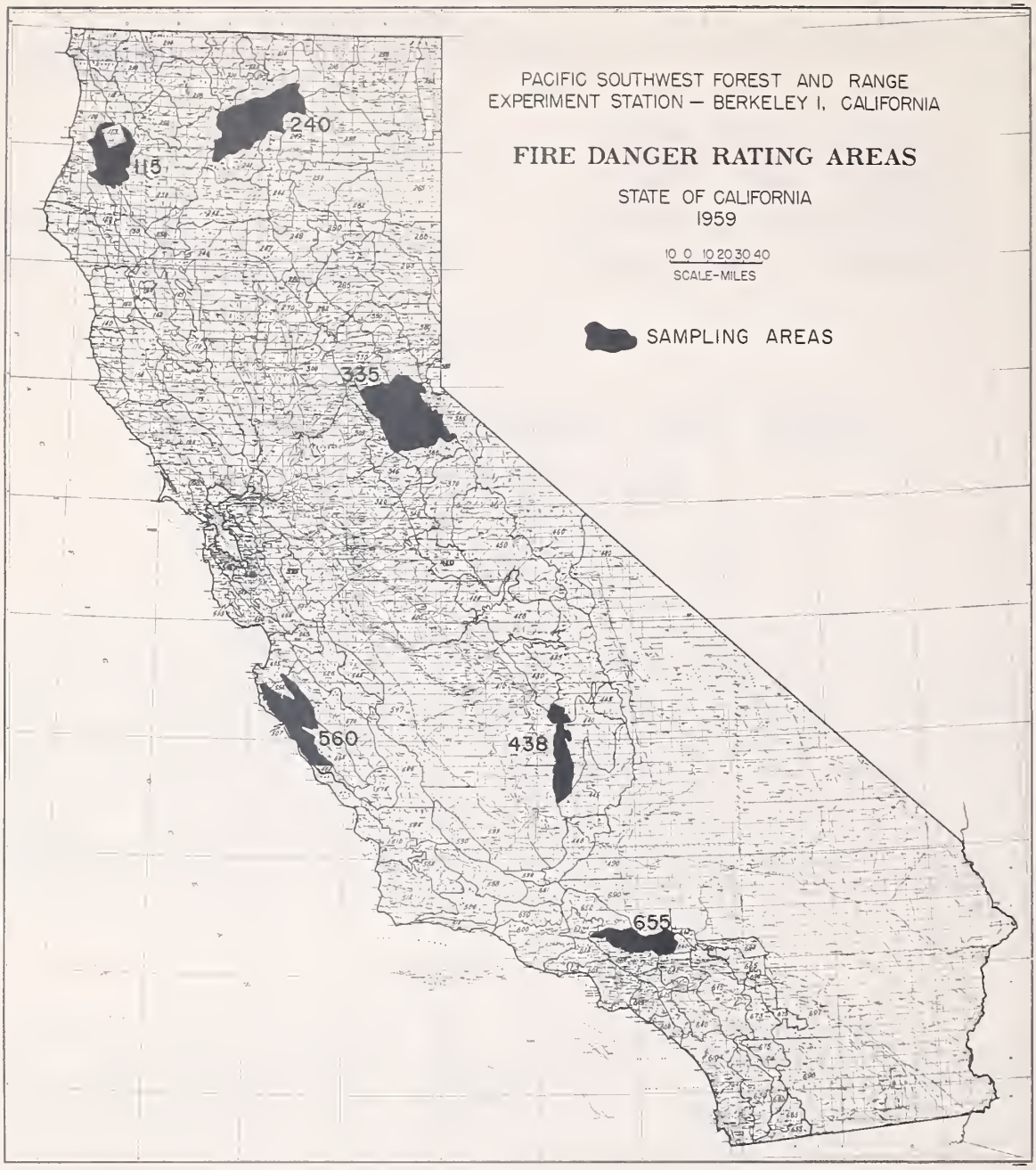
Abnormal dryness and extreme temperatures in 1960 gave California what has been called the worst fire history in recent times. By September 30, 5,100 fires had burned 250,000 acres. A dozen of these fires exceeded 3,500 acres each. Four were larger than 28,000 acres--an area the size of San Francisco city and county. The large fires certainly point to a severe season. For an appraisal of weather and fuel conditions leading to such fires, we can turn to three basic indexes of fire danger--the burning index, the ignition index, and the fire load index--the last two developed this year to aid in evaluating the fire weather severity from day to day, month to month, and year to year.

THE BASIC INDEXES

The ignition index measures the effects of weather on ignitability of fine forest fuels such as grasses, needles, and leaves. The higher this index, the more susceptible are the fuels to ignition by matches, sparks, or cigarettes. This index can be used as a guide for planning prevention action.

The burning index measures the effect of weather on the difficulty of fire control. It is based on how fast a fire spreads and how intensely the fire will burn. This index is used as a guide for planning fire suppression action.

The fire load index combines the ignition index and burning index into a single number summarizing the effects of weather on ignitability, rate of spread, and intensity of burning. This summary characteristic of the fire load index is then an expression of the potential fire prevention and suppression job necessary to meet the threat caused by weather. Within each fire danger rating area, the fire load index for a given period can be compared with the index for this period in other years, or under average conditions. When accumulated for the entire fire season, it indicates the total relative severity of the fire weather each year.



Location of sampling areas used to rate severity of 1960 season.

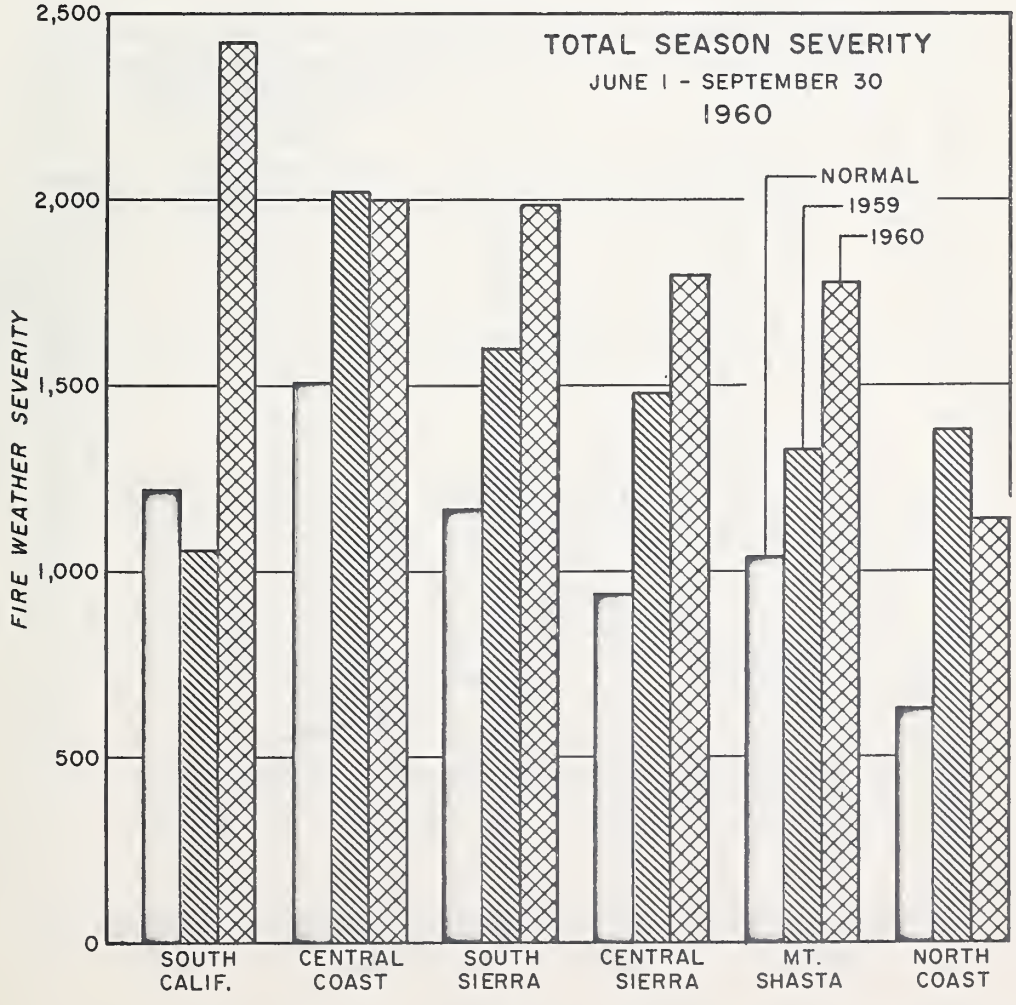
THE 1960 SEASON

To rate weather conditions for California in 1960, the seasonal severity indexes were compiled for six fire-danger rating areas in California wildlands.

General area	County	National Forest	Fuel type and fire danger rating area
North Coast	Humboldt	Six Rivers	Timber, FDR 115
Mount Shasta	Shasta-Siskiyou	Shasta-Trinity	Timber, FDR 240
Central Sierra	El Dorado	Eldorado	Timber, FDR 335
South Sierra	Tulare	Sequoia	Brush, FDR 438
Central Coast	Monterey	Los Padres	Brush, FDR 560
Southern California	Los Angeles	Angeles	Brush, FDR 655

SEASONAL FIRE WEATHER SEVERITY

For the season as a whole, weather conditions imposed a greater than normal load on protection organizations in all sample areas in 1960. The fire weather was more severe in 1960 than in 1959 in all areas except the Central Coast and North Coast. In terms of average conditions, both southern California and the Central Sierra had a seasonal severity twice normal. This double load is reflected in the major fires in these areas and corresponding severe burning conditions.

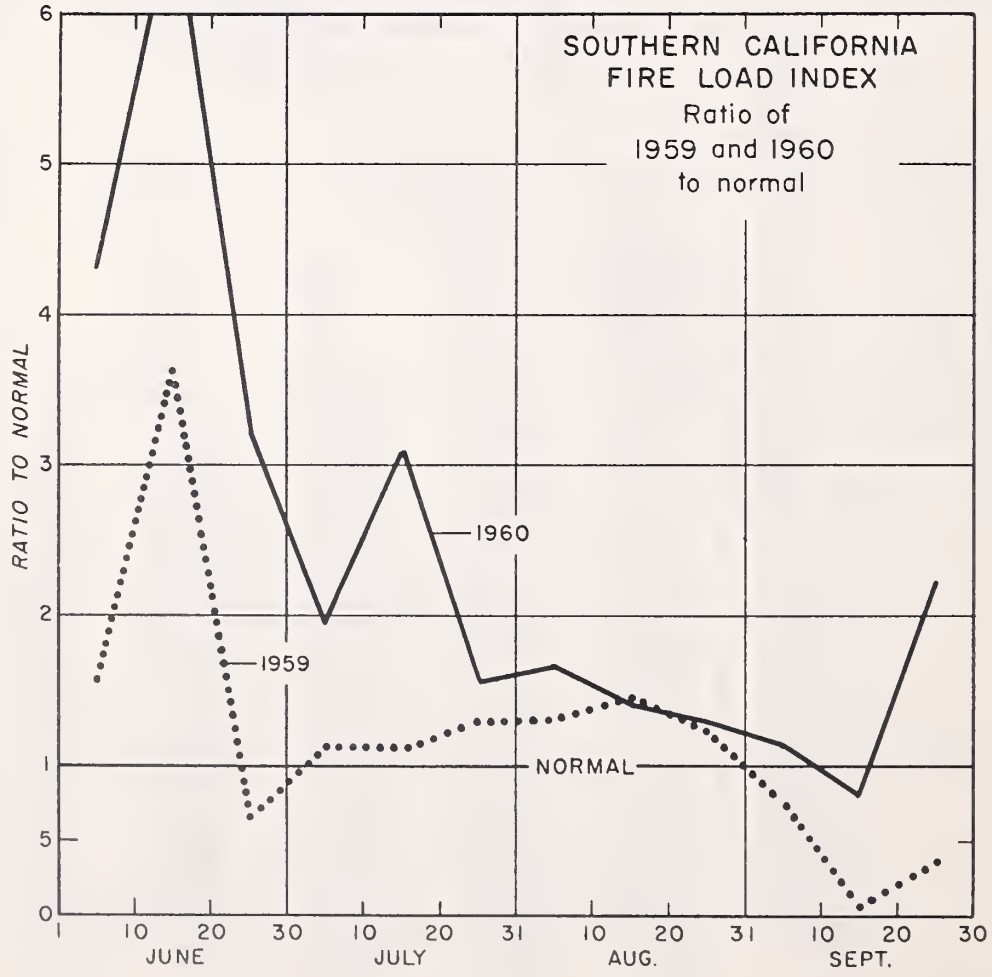


FIRE LOAD INDEXES BY 10-DAY PERIODS

In southern California, the 1960 season jumped off to a fast start in June because of high temperatures and low humidities. The resulting low fuel moistures boosted the fire load index to a peak of more than 6 times normal.

By mid-July, the vegetation was as dry as it normally is at the beginning of September, which is usually the worst month of the fire season in southern California. At this time another heat wave pushed the fire load index to a second peak--more than three times normal for this period. During this period the Angeles National Forest had the 14,737-acre Polecat fire, the 23,170-acre Johnstone fire and the 27,500-acre Magic Mountain fire. The adjoining Los Padres National Forest had the 11,870-acre White Mountain fire.

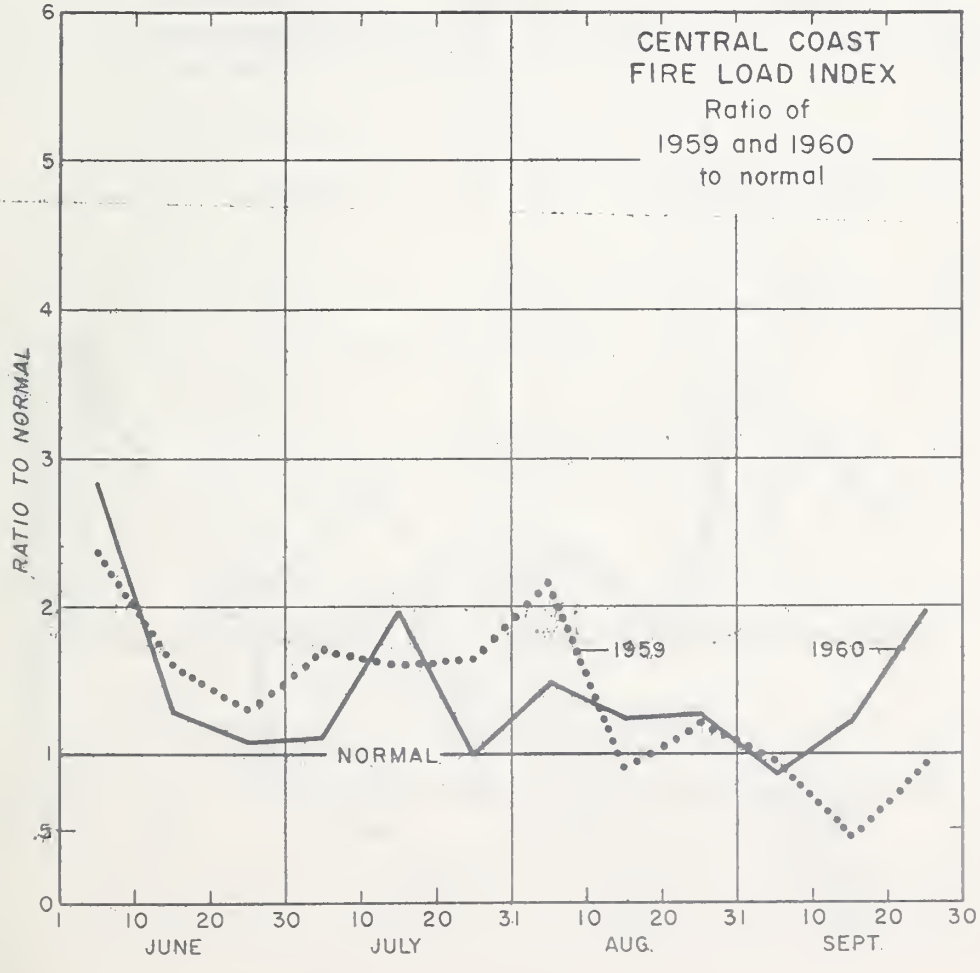
It must be remembered that these fire load graphs show the ratio of the actual index for a given 10-day period to the normal index for that period. Since the normal fire load increases as the season progresses, an index 6 times normal in June is not twice one that is 3 times normal in mid-July.



The Central Coast also had an above normal fire load index in June. By mid-June the Los Padres National Forest already had a 400-acre fire. Toward the end of the month the index lowered to almost normal conditions.

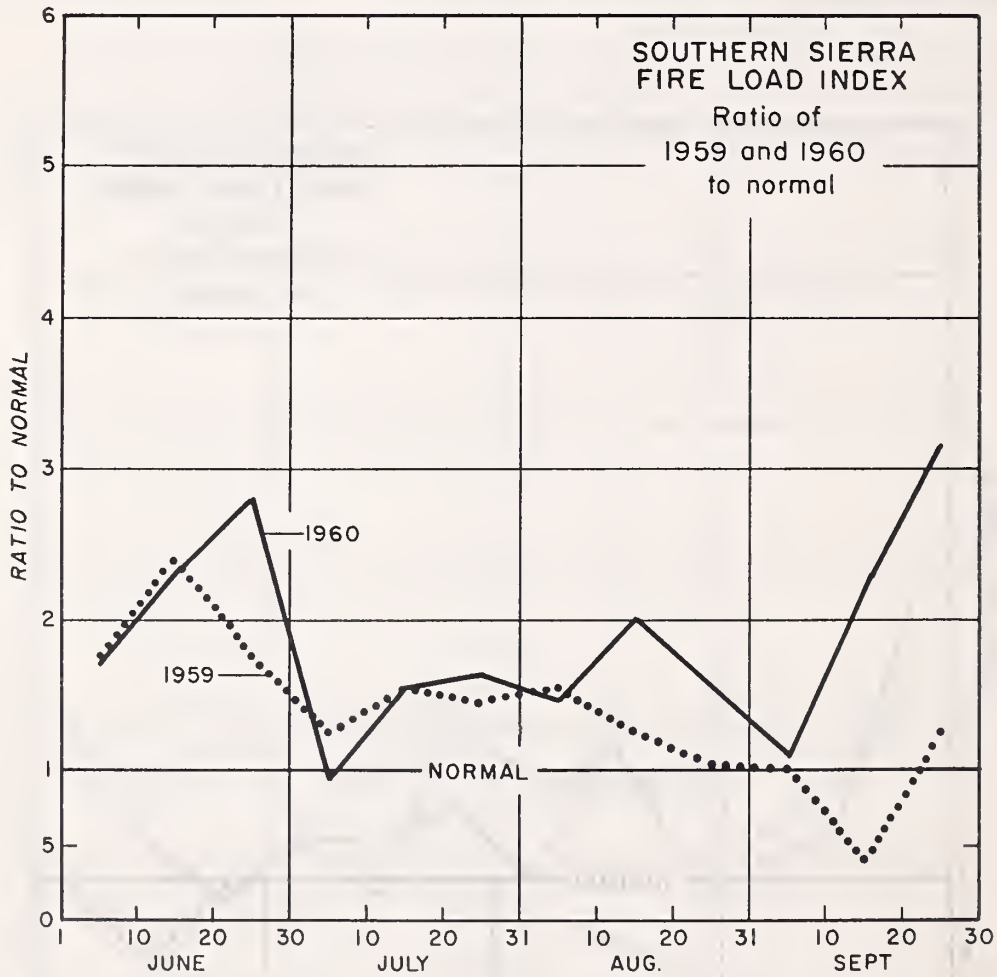
The July 1960 heat wave, however, jumped the fire load index to two times normal. In this general area, the California Division of Forestry fought the Weferling fire which burned over 50,000 acres of valuable watershed land and threatened the Hearst Castle State Park before it was controlled.

After July, the potential fire load gradually eased off toward normal. The almost normal conditions lasted until early September. Lack of autumn rains helped push the index back toward twice normal in late September.



In the southern Sierra the fire load index reached almost 2-1/2 times normal in late June 1960. At this time Sequoia National Park lost 4,950 acres in the Tunnel Rock fire, and the Coffee Camp fire in Sequoia National Forest, burned 1,100 acres.

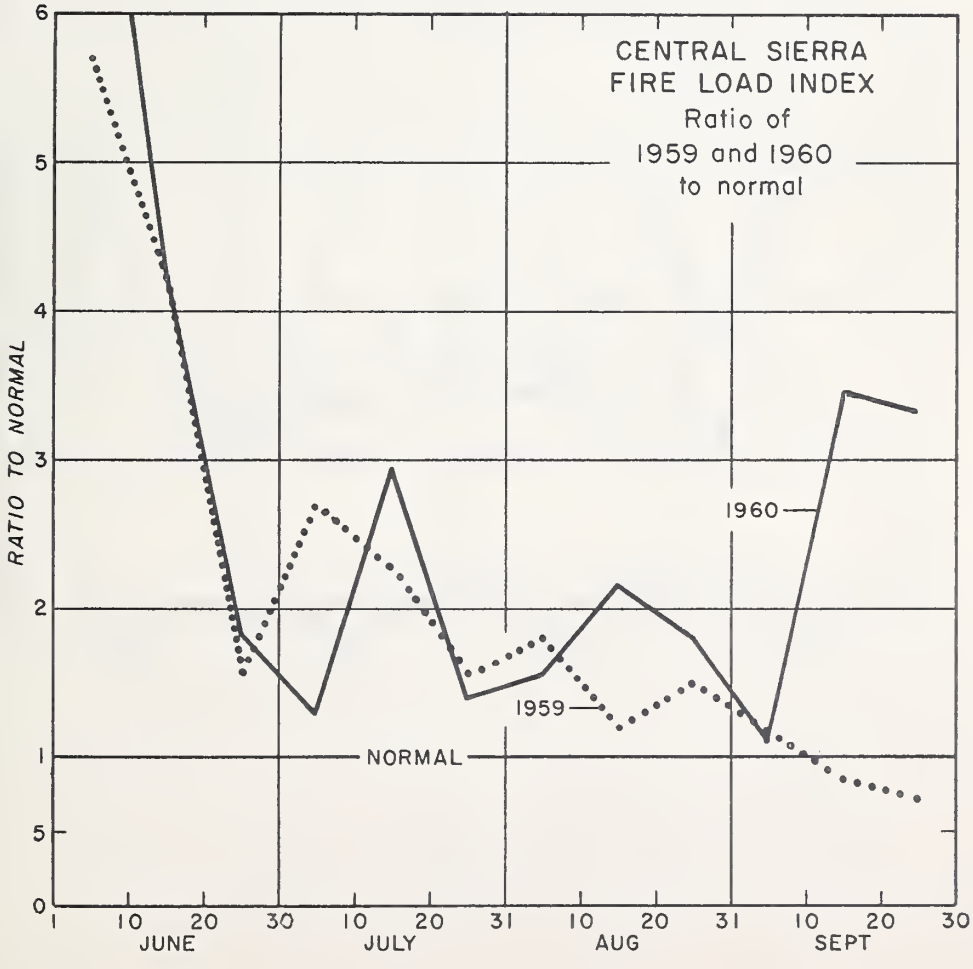
As in most parts of the State, the fire load index climbed during September because of extended dry weather, warm temperatures, and fall winds. In contrast, 1959, with a general fall rain, had a fire load index below normal by mid-September in this area.



The central Sierra had above normal fire load indexes throughout all of the 1960 season. June started with an index 6 times normal. In July, the mid-month index was 3 times normal. At this time the Stanislaus National Forest had the 2,000 acre Flora fire in a timbered area. Fire-weather conditions eased off toward the end of July but were still worse than normal.

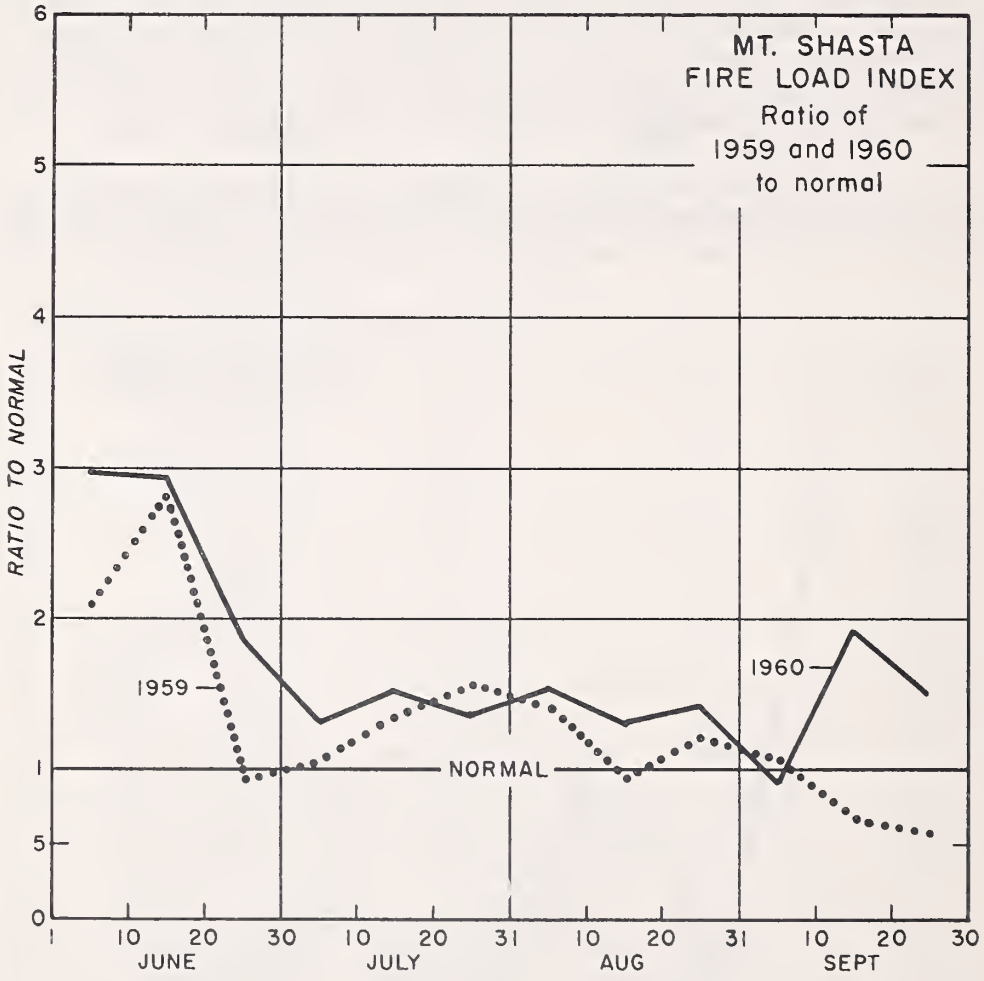
By mid-August the index again moved far above normal. The 10-day average was 2-1/4 times normal. The 4,020-acre Mosquito fire, the 3,605-acre Virgilia fire, the 44,000-acre Donner Ridge fire, and the 45,900-acre Volcano (Homestake Mine) fire started during this period on the Plumas and Tahoe National Forests. At the same time, the California Division of Forestry also fought the 5,000-acre North San Juan fire not far from Nevada City. The 10 days of extreme fire weather pushed these 5 fires to a total of 102,000 acres and a public and private timber loss of about 450 million board feet. Never have such losses been recorded in this area over so short a span of time.

In early September, the 1960 fire load index approached normal but then climbed high again with warm and windy weather. No major fires started on the westside of the central Sierras in September.



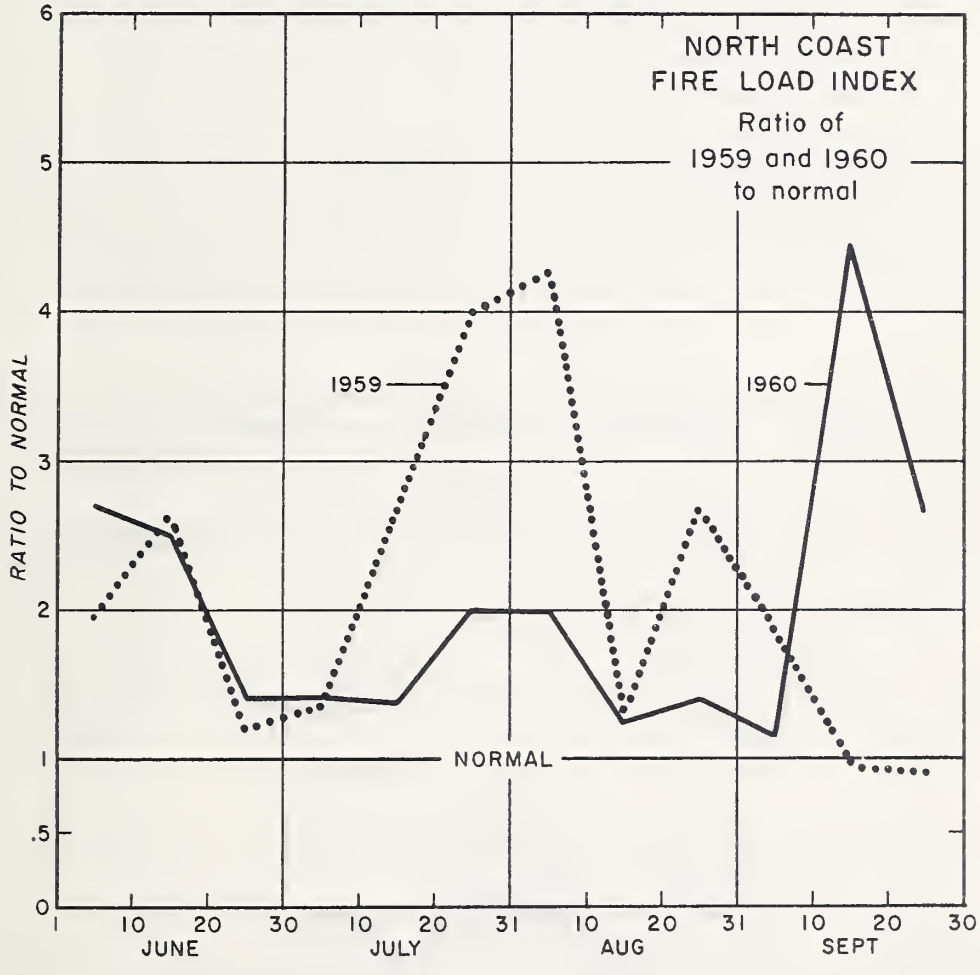
Northern California around Mount Shasta had above normal fire load indexes throughout 1960 except for the first 10 days in September. Weather conditions, however, were not as severe as throughout the rest of the State.

As in most of California, the Mount Shasta area experienced the worst fire weather in June and late September, but no major fires were started during these periods.



On the north California coast three major peaks of above normal fire load indexes occurred in 1960. Early June, late July, and late September had fire weather conditions more severe than is normally expected during these periods. A few timber fires did occur during the last two peaks but all were controlled at less than a thousand acres.

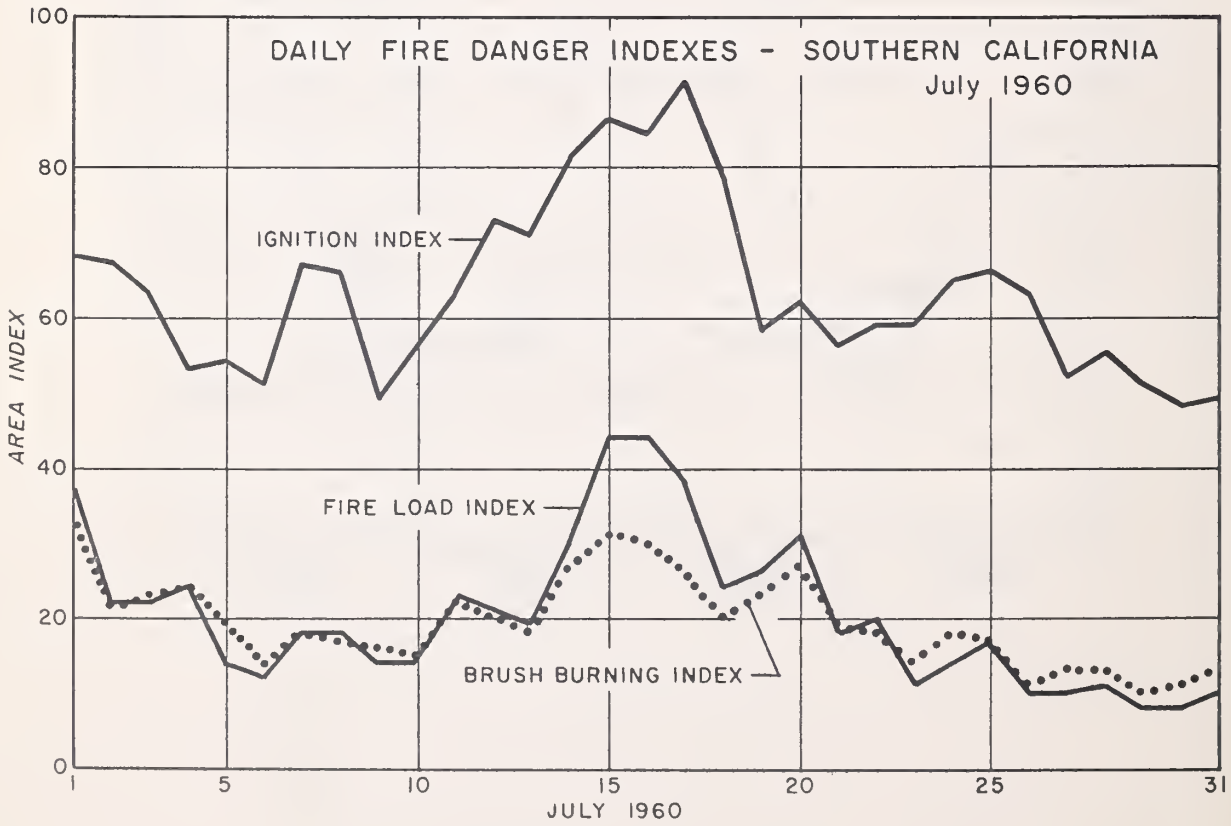
The potential for fire was high in late September because of continued dry weather, and the month closed with the fire load index almost three times normal.



DAILY FIRE DANGER

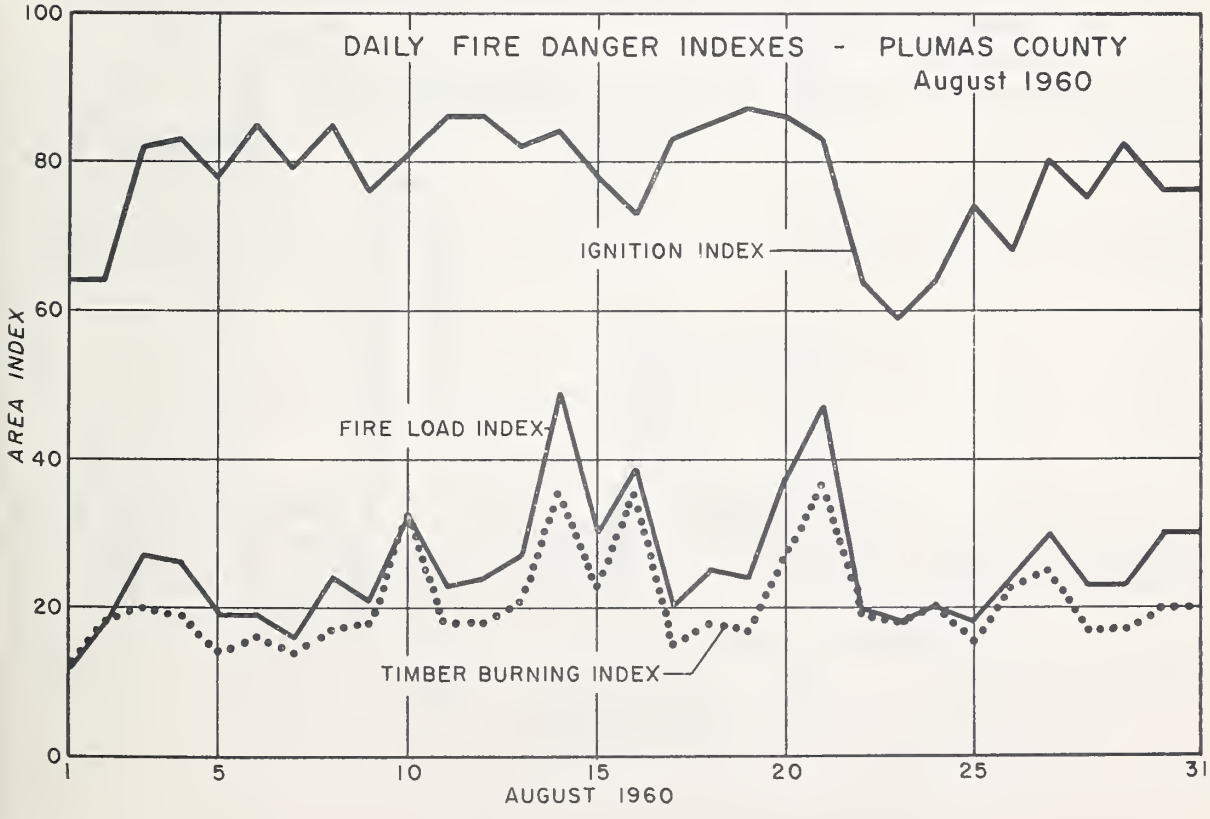
In southern California a hot, dry June started rapid drying of both green and dead fuels. The mid-July heat wave stepped up the process so that fire danger indexes climbed to all time highs for so early in the fire season. During this period the air was quite unstable, and on several days thunderstorms occurred. Under such a combination of weather conditions, fires could be expected to start easily and behave erratically so that control would be difficult.

Fires started--234 of them (almost 4 times the average)--and 230 were held at relatively small acreages. Four of the fires blew up and became major conflagrations. The man-caused Polecat fire, Angeles National Forest, started on July 17, when the ignition index peaked at 91. Under blow-up weather conditions it made major runs on the 18th and 20th. While fire forces were committed to controlling the Polecat fire, lightning storms started additional fires. On July 20, with the burning index in the extreme range, the Johnstone (Angeles National Forest), Magic Mountain (Angeles National Forest), and White Mountain (Los Padres National Forest) fires were started by lightning. Weather-induced blow-up conditions prevailed on July 20 and 21, and resulted in these other three fires also reaching the conflagration stage.



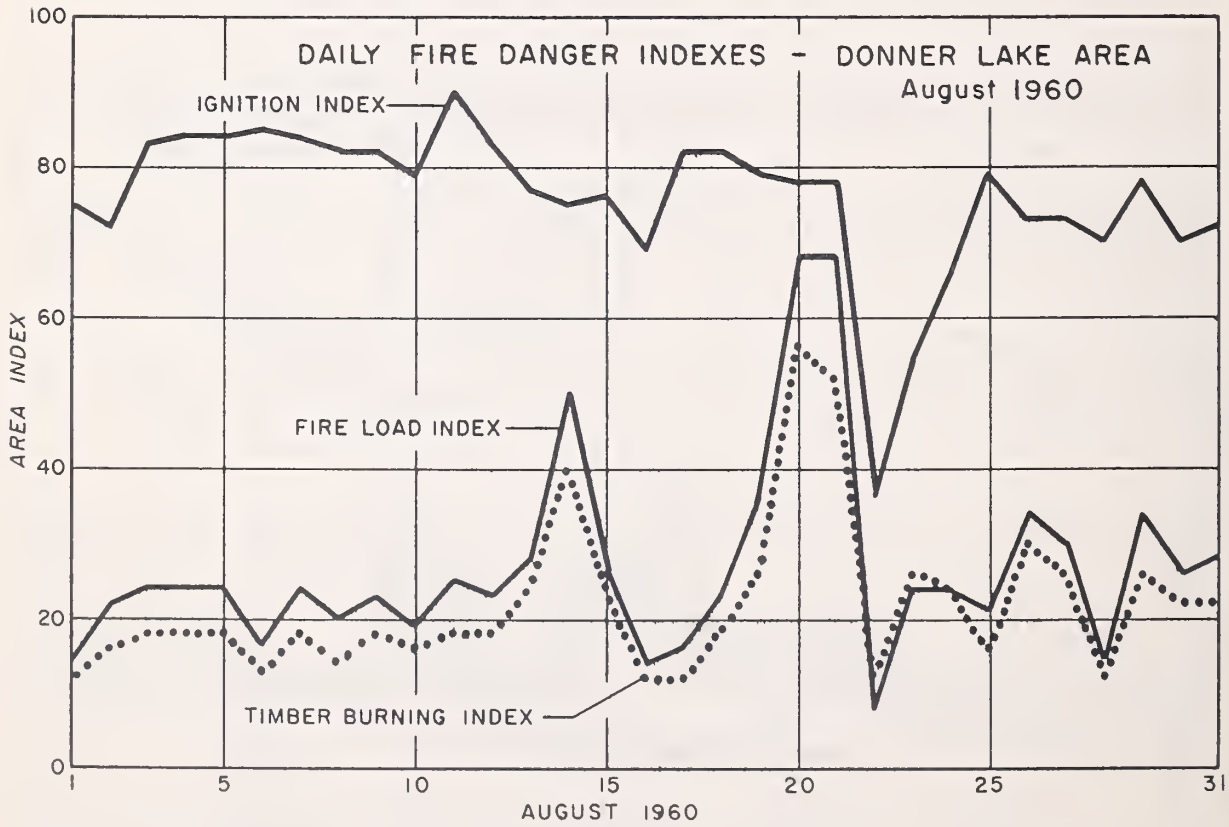
In Plumas County the temperature was 95 to 105 degrees in mid-August compared to a normal of 83. The amount of moisture in fine dead fuels such as grass and leaves was about 2 percent instead of the usual 5 percent. Heavier fuels were drier than average.

As a result the burning index was very high on August 13 and 15, when the Mosquito and Virgilia fires started. On the second day of each fire relative humidity dropped an average of about 6 percent, down to the 10 or 11 percent level. Fine fuel moisture dropped proportionately and thereby raised the burning indexes into extreme. With the ignition index already above 70, fire control was made more difficult by fires spotting across firelines. Cooler weather by August 17 lowered the burning indexes from extreme down to high.



In the Donner Lake area the potential for fire starts and extreme fire behavior was even greater by August 20, when crews were still mopping up the timber fires to the north on the Plumas National Forest. The ignition index of forest fuels was high, having hovered around 80 for several days. High winds and low fuel moistures boosted the burning index to 56, far into the extreme class, indicating fast fire spread and very intense burning conditions.

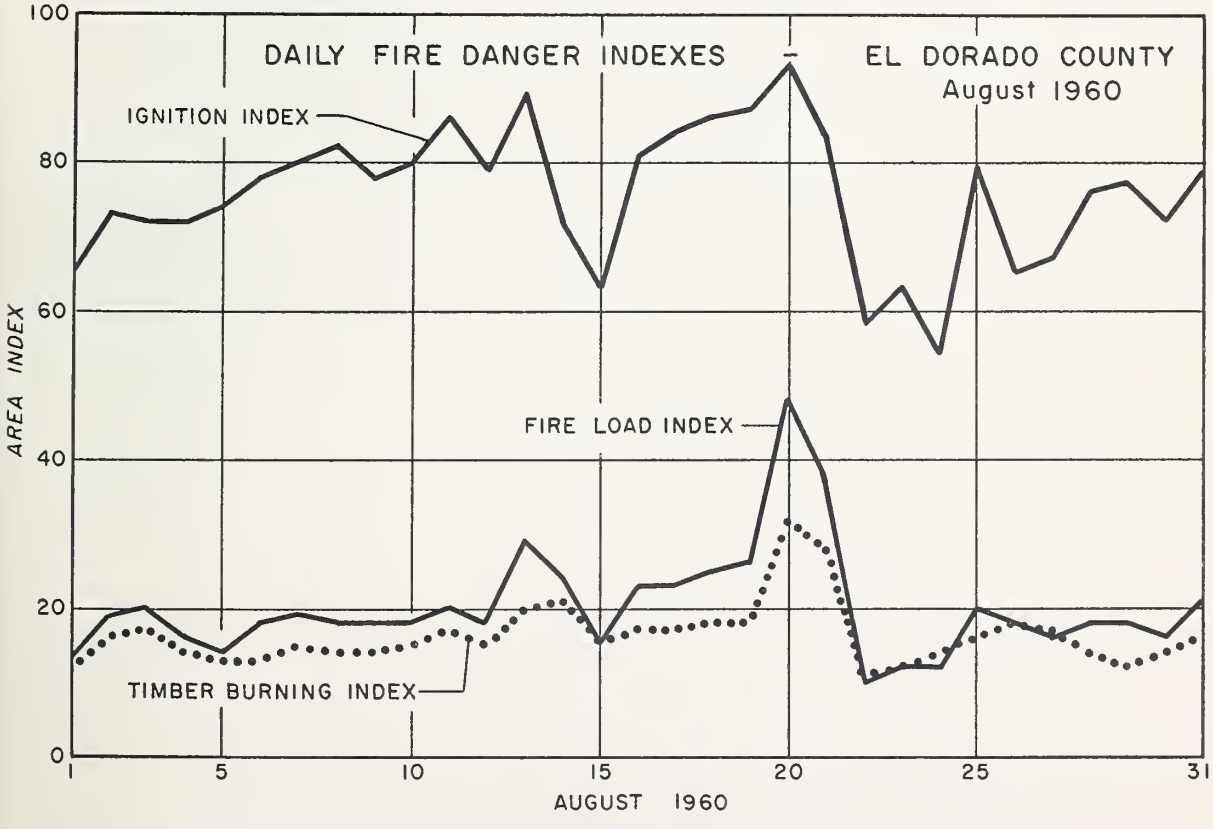
The Donner Ridge fire started August 20. Its behavior was as bad as indicated by the indexes and it ran many miles the next day. A cold front passage on the 21st brought higher humidities and lower temperatures. However, the speed of the winds more than offset the immediate effect of the damper and cooler air. After the colder air mass took full effect--as shown by all indexes dropping to low levels--fire activity slowed noticeably.



August 20 also saw the start of the Volcano (Homestake Mine) fire near Forest Hill, California, on both the Tahoe and Eldorado National Forests. The ignition index had reached 93, indicating a high susceptibility of fuels to ignition because of very low fine fuel moisture, and consequently a high danger of spot fires.

Fire spread by spotting caused the major runs of the Volcano fire on August 20 and 21. Extreme burning indexes of 32 and 28 on the first two days of the fire were also reflected in the fire behavior. Large patches of timber burned intensely as a unit and lifted great quantities of partially burned needles and leaves into the air. Prevailing surface winds carried the ignitors ahead to start concentrations of spot fires, which coalesced into intense unit area fires and were soon joined by the steadily advancing ground fire.

Like the Donner Ridge fire, the Volcano fire moderated appreciably after the cold front passed and cool damp air dominated the area. But on August 25 the ignition index again climbed toward 80, and fine fuels were again sufficiently dry to be easily ignited by flying sparks.



CONCLUSION

1960 appears to be the most severe fire season in recent times, as fire losses testify. So do three basic indexes of the wildland fire danger rating system which were applied to six sample areas in California. The consistently high ignition, burning, and fire load indexes appear to measure accurately the influence of hot dry weather on forest fuels. Very low fine fuel moistures resulted in high ignition indexes, and more than 5,000 fires started through September 30. The high burning indexes are reflected in the behavior of the fires that became large. Many fires plus large acreage losses are also reflected by the seasonal fire weather severity which indicates a fire job load approaching almost twice normal throughout California. These indexes appear to show a great deal of promise for current planning of fire prevention and suppression activities.